numerous fibrils and buds. In the funnel-tube the roots made a perfect tissue of fibres. In the dry earth of the funnel the roots were less extensively developed, yet exhibited some juicy buds. The stem and the young axillary leaf-buds were also full of sap. The water-roots being cut away, the plant was put into garden soil, and placed in a conservatory, where it grew vigorously, and in May bore two offshoots.

The experiment makes it quite certain that plants extend a portion of their roots into the subsoil chiefly for the purpose of gathering supplies of water.—*Henneberg's Journal für Landwirthschaft*, 1863, p. 280 *et seq.*

On the Air of the Swimming-Bladder of Fishes.
By A. Moreau.

The author in the present paper describes the conditions under which the amount of oxygen in the swimming-bladder of fishes may be augmented. In the Physostomous fishes the duct of the swimming-bladder enables the fishes to expel the air from the bladder, or to take in air from the atmosphere by coming to the surface of the water.

The process to which the author subjects these fishes is as follows:—The fish is placed in a vessel of water under the bell of the air-pump; as the air becomes rarefied, bubbles escape from the mouth and opercular apertures. When, from the quantity of air expelled and the descent of the barometer which measures the pressure within the bell, it is supposed that nearly all the air is exhausted from the swimming-bladder, atmospheric air is admitted into the bell; and the fish, which previously floated freely, immediately falls to the bottom of the vessel, owing to the diminution in volume of the swimming-bladder. The fish is then transferred (care being taken that he does not get his head out of water) into a large vessel in which the water is constantly renewed. The fish then lies at the bottom of this vessel, creeping about rather than swimming; his efforts to rise to the surface are rendered abortive by a partition placed below it. In a few days, or, with some species, in a few hours, the fish begins to swim with more facility, indicating that the swimming-bladder has become filled with fresh air, which has not been derived from the atmosphere. The fish is then killed by the section of the spinal cord effected under water; the duct is tied and the swimming-bladder removed to the mercurial trough, in order that the air which it contains may be collected and examined. The analysis of this air shows an amount of oxygen far superior to that of the air expelled under the action of the air-pump, and also to that contained in the air dissolved in the water.

Eight Tench were taken under the same conditions; seven were killed, and the air of their swimming-bladders gave 8 per cent. of oxygen. The eighth was treated as above, and killed in a fortnight; the air of its swimming-bladder gave 60 per cent. of oxygen.

Of three Congers, taken under identical conditions, one killed at once gave 30 per cent. of oxygen. Another was subjected to the action of the air-pump until the column of mercury descended to 20 centimetres (= 8 inches), and then placed in a basin of sea-water; in two days it gave 62 per cent. of oxygen. The third was subjected to the air-pump at a pressure of 9 centimetres (= 3·6 inches) on two consecutive days, then placed in the basin of sea-water, and killed twenty-four hours afterwards; the air in its swimming-bladder gave 87 per cent. of oxygen.

These examples suffice to prove that, in Physostomous fishes placed where they cannot obtain air from the atmosphere, the swimming-bladder is soon refilled with new air remarkably rich in oxygen, and, further, that this is the case even in species which do not possess the vascular organs known as the *red bodies*.

In the case of fishes with a completely closed swimming-bladder, the author punctured the bladder by means of a fine trocar, and collected a portion of its air under water. The thickness of the tissues penetrated prevents the access of water to the air-bladder through the very narrow aperture made by the trocar, which closes as the instrument is withdrawn.

Four Perch, taken under the same circumstances, were punctured under water. Their air contained from 19 to 25 per cent. of oxygen. When killed, ten days afterwards, the amount of oxygen was from 40 to 65 per cent.

Two Gilt-heads (*Sparus auratus*) furnished, when punctured, an air containing 16 to 17 per cent. of oxygen. When killed, two days afterwards, they gave 58 and 59 per cent.

A Wrasse (*Labrus variegatus*) gave on the first puncture 19 per cent., and twenty-four hours afterwards 57 per cent. of oxygen. Another Wrasse gave 18 and 85 per cent.

As the swimming-bladder cannot be completely emptied by the above processes, and the remainder of the air, which is very rich in nitrogen, is mixed with that which is finally obtained from the fish, it would appear that, in some cases at least, pure oxygen must make its appearance in the swimming-bladder.

In a previous communication the author stated that asphyxia is the cause of diminution in the proportion of oxygen in the swimming-bladder, and also that this proportion diminishes by degrees, and only reaches zero in the last moments of the life of the fish. If the complete disappearance of the oxygen be desired, the fish must be asphyxiated, in a larger quantity of water in proportion as he is more vigorous and contains air rich in oxygen in his swimming-bladder. Those fishes in which the swimming-bladder possesses no red bodies, present a comparatively slight diminution of oxygen when asphyxiated. Carbonic acid exists in the air of the swimming-bladder; but in most species examined by the author it was rarely present in a larger proportion than 2 or 3 per cent. Asphyxiated fishes do not exhibit an increase of this gas proportional to the diminution of oxygen.

The author sums up his results as follows:—The air of the swimming-bladder presents a composition which may vary more or less, relatively to the proportion of oxygen, under the following circumstances:—

1. The oxygen diminishes and disappears in asphyxia and other morbid conditions.

2. In the fishes with an open, as in those with a closed swimming-bladder, the air is renewed without being derived from the atmosphere, and the rapidity of this renewal is proportional to the vigour of the fish.

3. The new air presents an amount of oxygen far superior to the proportion of that gas usually contained in the air of the swimming-bladder, and also far superior to that contained in the air dissolved in the water.—*Comptes Rendus*, Nov. 16, 1863, p. 816.

On the Intercellular Substance and the Milk-Vessels in the Root of the common Dandelion. By Dr. August Vogl.

The root of the common Dandelion possesses a central woody body, surrounded by a thick, fleshy, strongly milky rind. If fine sections of the root be treated under the microscope with various chemical reagents, it appears that the intercellular substance occurring in the root consists chiefly of pectose—the same substance which occurs in unripe fruits and in turnips and carrots. By this it is shown that this substance is by no means a secretion, but a product of conversion of the cellulose of the cell-membranes. This conversion is chemical in its nature, and proceeds from without inwards. The production of the milk-vessels in the root of the Dandelion stands in connexion with this pectinic metamorphosis. The milk-vessels which occur in this plant are perhaps among the most ramified which occur anywhere in plants. They form main stems, which, united into bundles, pass through the bark in a direction parallel to the axis of the root. These main stems throw out a quantity of lateral shoots—sometimes as short transverse branches of intercommunication, sometimes as cæcal branches of greater or less length, which are either inflated into a knob or drawn out to a hair-like fineness at the extremity; the different bundles are connected in a tangential direction, and thus form large reticulated systems around the woody nucleus. On examining into their origin, it appears that their main stems are produced by the amalgamation of the so-called conducting cells (*Leitzellen, Siebzellen*) which accompany the bundles of milk-vessels, and probably constitute the organ for conducting back the juices elaborated in the leaves. This fusion is induced by the conversion into pectose of the membranes of the cells, consisting at first more or less entirely of cellulose.—*Bericht der kais. Akad. der Wissenschaften in Wien; Math.-naturw. Classe*, Dec. 17, 1863, p. 10.